DETAILED COURSE DESCRIPTION

Course Number PHYS 311

Course Title Classical Mechanics

Target audience The course is designed for junior level physics majors; however other engineering and science majors with the correct preparation are very welcome. Nb: this is a course that is mandatory for all Physics Majors. Therefore, this is a course whose audience is composed by students who intend to pursue graduate studies, but also by students who will want to find a job after the BS degree. Topics of choice must take this fact into consideration.

Prerequisites PHYS 136 or 138

Catalog description Kinematics and dynamics of single particles, systems of particles, and rigid bodies. Oscillations. Central forces. Gravitation. Includes computational methods. Required course for all physics majors.

(RE) Prerequisite(s): 136 or 138 or 231; Computer Science 102.

Expected previous knowledge

Concepts	Newtonian mechanics at a freshman level (kinematics, forces, torque, inertia etc.), at the level of PHY 136-138 etc
Skills	Familiarity with calculus and calculus concepts (vectors, vector, differential and integral calculus), linear algebra (matrices, determinants etc.), differential equations (ODE).

Course Objectives

- **Gain deeper understanding of classical mechanics**. Consolidate the understanding of fundamental concepts in mechanics such as force, energy, momentum etc. more rigorously as needed for further studies in physics, engineering and technology.
- **Advance skills and capability for formulating and solving problems**. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems.
- **Increase mathematical and computational sophistication**. Learn and apply **advanced mathematical techniques** and methods of use to physicists in solving problems. Develop some capabilities for **numerical/computational methods**, in order to obtain solutions to problems too difficult or impossible to solve analytically.

Sample Text

"Analytical Mechanics", by Fowles and Cassidy, Thompson Brooks/Cole.

"Getting started with MATLAB", by Rudra Pratap, Oxford

Minimum Material Covered

Kinematics in 1, 2 and 3D

Forces: constant forces, time, velocity and position-dependent forces. Conservative fields

Oscillations: free, dumped and forced oscillations, resonances

Gravitation and central forces, Kepler problem

Kinematics and dynamics of a system of particles

Rigid body: planar motion

Rigid body: motion of a rigid body in 3D, inertia tensor